# 《大气污染防治原理》作业机翻

来自 Xzonn 的小站

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**注：只有作业题目机翻，没有答案。**

# 第 1 次作业

## Fundamentals of Air Pollution Engineering

### 2.2

A high-volatile bituminous coal has the following characteristics:

高挥发分烟煤具有以下特点：

| Proximate analysis 近似分析 | | |
|---|---|---|
| Fixed carbon | 固定碳 | 54.3% |
| Volatile matter | 挥发性物质 | 32.6% |
| Moisture | 水分 | 1.4% |
| Ash | 灰分 | 11.7% |
| Ultimate analysis 终极分析 | | |
| C | | 74.4% |
| H | | 5.1% |
| N | | 1.4% |
| O | | 6.7% |
| S | | 0.7% |
| Heating value | 热值 | $30.7 \times 10^6$ J $kg^{-1}$ |

It is burned in air at an equivalence ratio of 0.85. $500 \times 10^6$ W of electric power is produced with an overall process efficiency (based on the input heating value of the fuel) of 37 %.

它在空气中以 0.85 的当量比燃烧。产生 $500 \times 10^6$ W 的电力，整体工艺效率（基于燃料的输入热值）为 37%。

(a) Determine the fuel and air feed rates in kg $s^{-1}$.

确定以 kg $s^{-1}$ 为单位的燃料和空气进料速率。

(b) Determine the product gas composition.

确定产品气体成分。

(c) Sulfur dioxide is removed from the flue gases with a mean efficiency of 80% and the average output of the plant is 75% of its rated capacity. What is the $SO_2$ emission rate in metric tonnes ($10^3$ kg) per year?

从烟道气中去除二氧化硫的平均效率为 80%，工厂的平均产量为其额定容量的 75%。每年以公吨（$10^3$ kg）为单位的 $SO_2$ 排放量是多少?

### 2.5

Methanol shows promise as an alternate fuel that could reduce nitrogen oxide emissions. The reduction is attributed to lower flame temperatures. Compare the adiabatic flame temperature for combustion of pure methanol at $\varphi = 1$ with that of methane (Problem 2.4). Initial fuel and air temperatures are 298 K. The enthalpy of formation of liquid methanol is $\Delta h_f^\circ$ (298 K) = -239,000 J mol$^{-1}$.

甲醇作为替代燃料显示出前景，可以减少氮氧化物排放。降低归因于较低的火焰温度。将 $\varphi = 1$ 时纯甲醇燃烧的绝热火焰温度与甲烷燃烧的绝热火焰温度进行比较（问题 2.4）。初始燃料和空气温度为 298 K。液体甲醇的形成焓为 $\Delta h_f^\circ$（298 K）= -239,000 J mol$^{-1}$。

### 2.6

The bituminous coal of Problem 2.2 is burned in air that has been heated to 590 K. To estimate the maximum temperature in combustion, compute the adiabatic flame temperature for stoichiometric combustion assuming complete combustion. The specific heats of the coal carbon and ash may be taken as $\bar{c}_{pc}$ = 1810 and $\bar{c}_{pa}$ = 1100 J kg$^{-1}$ K$^{-1}$, respectively. The ash melts at 1500 K with a latent heat of melting of $\Delta\bar{h}_m$ = 140 J kg$^{-1}$.

问题 2.2 的烟煤在已加热到 590 K 的空气中燃烧。为了估计燃烧的最高温度，假设完全燃烧，计算化学计量燃烧的绝热火焰温度。煤炭和灰分的比热分别取 $\bar{c}_{pc}$ = 1810 和 $\bar{c}_{pa}$ = 1100 J kg$^{-1}$ K$^{-1}$。灰分在 1500 K 熔化，熔化潜热 $\Delta\bar{h}_m$ = 140 J kg$^{-1}$。

### 2.9

A fuel oil containing 87% C and 13% H has a specific gravity of 0.825 and a higher heating value of 3.82 × 10$^{10}$ J m$^3$. It is injected into a combustor at 298 K and burned at atmospheric pressure in stoichiometric air at 298 K. Determine the adiabatic flame temperature and the equilibrium mole fractions of CO, $CO_2$, $H_2$, $H_2O$, $O_2$, and $N_2$.

含 87% C 和 13% H 的燃料油比重为 0.825，热值较高，为 3.82 × 10$^{10}$ J m$^3$。将其注入 298 K 的燃烧室，并在 298 K 的化学计量空气中在大气压下燃烧。确定绝热火焰温度和 CO、$CO_2$、$H_2$、$H_2O$、$O_2$ 和 $N_2$ 的平衡摩尔分数。

# Air Pollution Control Engineering

### P66, 1

The range of droplet sizes in a cloud was determined to be as follows:

云中液滴大小的范围确定如下：

| **Range of drop diameter -microns**<br>**液滴直径范围 - 微米** | **Number of drops**<br>**滴数** |
|---|---|
| 5-8 | 4 |
| 8-11 | 6 |
| 11-14 | 15 |
| 14-17 | 24 |
| 17-20 | 24 |
| 20-23 | 12 |
| 23-26 | 4 |

续表

| Range of drop diameter -microns<br>液滴直径范围 - 微米 | Number of drops<br>滴数 |
|---|---|
| 26-29 | 4 |
| 29-32 | 4 |
| 32-38 | 3 |

a. Determine the number median diameter.

确定数中值直径。

b. Determine the mass median diameter.

确定质量中值直径。

c. Determine the Sauter mean diameter.

确定 Sauter 平均直径。

d. What weight fraction of the sample is represented by drops greater than 20 μm in diameter?

直径大于 20 μm 的水滴代表样品的重量分数是多少?

e. What is the population density of the 20-23 μm grade?

20-23 μm 等级的人口密度是多少?

f. Can the distribution be reasonably well described as log-normal? (Hint: try plotting $\Delta n/\Delta \ln d_p$ vs $\ln d_p$; also try the upper-limit function). If so, find the two constants for the distribution.

分布是否可以合理地描述为对数正态分布？（提示：尝试绘制 $\Delta n/\Delta \ln d_p$ vs $\ln d_p$；也尝试使用上限函数）。如果是，请找出分布的两个常数。

### P66, 5

The spray from a certain nozzle gave a drop-size distribution which was log-normal, with an AMD of 240 microns and a standard geometric dispersion of 2.00. For this spray:

来自某个喷嘴的喷雾给出了对数正态分布的液滴尺寸分布，AMD 为 240 μm，标准几何色散为 2.00。对于这种喷雾：

a. What fraction of the total surface would be on drops between 100 and 200 microns in diameter?

直径在 100 到 200 μm 之间的液滴占总表面的几部分?

b. What is the value of the “surface to diameter” mean $\bar{D}_{1,1}$ ?

“表面对直径” 的值是什么意思 $\bar{D}_{1,1}$ ?

c. What is the value of the maximum population density?

最大人口密度的值是多少?

d. At what size does this value occur?

这个值出现的大小是多少?

### P133, 1

The particle size distribution of a certain dust, as obtained by an analysis conducted partly by a Coulter Counter and partly by an Anderson Impactor, may be represented by two straight lines on a log-probability plot. These lines intersect at 5.5 μm and 19.5% finer-than, with the Coulter portion having a $\sigma_g = 0.205$, and the Anderson portion a $\sigma_g = 11.1$, with the

Anderson covering the finer range. This dust is to be collected by a device which has a grade efficiency performance given by the following equation:

通过部分由 Coulter Counter 和部分由 Anderson Impactor 进行的分析获得的特定粉尘的粒度分布可以用对数概率图上的两条直线表示。这些线在 5.5 μm 和 19.5%处相交，Coulter 部分的 $\sigma_g = 0.205$，Anderson 部分的 $\sigma_g = 11.1$，Anderson 覆盖更精细的范围。该粉尘将由具有以下等式给出的分级效率性能的设备收集：

$$n_M = 1 - \exp(-2(1.28 \times 10^{-2} d_p^2)^{0.315})$$

where $d_p$ is in microns. For this operation, find:

其中 $d_p$ 以微米为单位。对于这个操作，找到：

a. the “cut diameter”;

“切割直径”；

b. the overall efficiency;

整体效率;

c. the particle size distribution of the dust emitted;

排放粉尘的粒度分布;

d. the rate of emission, per 100 kg of dust fed.

每 100 kg 粉尘的排放率。

## P133, 4

The grade efficiency of a certain gravity (settling chamber) collector was found to be 20% on particles of a certain size and 81% on particles twice as large. Assuming the particles obey Stokes Law, what type of model might represent this collector performance? Would your answer be the same if the grade efficiencies were 25% and 50% respectively?

发现某种重力（沉降室）收集器的分级效率对于特定尺寸的颗粒为 20%，对于两倍大的颗粒为 81%。假设粒子服从斯托克斯定律，什么类型的模型可能代表这种收集器性能？如果成绩效率分别为 25%和 50%，您的答案是否相同?

## P133, 5

The power consumption of a certain collector was measured as 15 kW. It was processing a stream of gas having an average molecular weight of 32, at 300 °F and 15.2 psia, through a duct 18’’ by 36’’ in cross-section at an inlet velocity of 50 ft/sec.

某个收集器的功耗测量为 15 kW。它在 300 °F和 15.2 psia 下以 50 ft/sec 的入口速度通过横截面为 18 英寸 × 36 英寸的管道处理平均分子量为 32 的气流。

Find: (a) the pressure drop across the collector;

求：(a) 集热器两端的压降;

(b) the number of inlet velocity heads of frictional energy loss.

(b) 摩擦能损失的入口速度头数。

## P133, 7

It has become necessary to control the emission of cement dust from the kiln of a Portland Cement plant in which the operating conditions are as follows: temperature = 250 °F; pressure = 1 atm; feed rate to kiln = 5 tons/hr; emission rate of dust (uncontrolled) = 230 lb/ton of feed; air flow = 159,600 acf/ton of feed. The dust may be regarded as equivalent of

Stairmand Fine. The emission regulations are given in Chapter 1.

有必要控制波特兰水泥厂水泥窑的水泥粉尘排放，其操作条件如下：温度 = 250 °F；压力 = 1 atm；窑的进料速度 = 5 tons/hr；粉尘排放率（不受控制）= 230 lb/ton 饲料；空气飞行 = 159,600 acf/ton 饲料。灰尘可被视为等同于 Stairmand Fine。排放法规在第 1 章中给出。

a. Select some possible kinds of collection equipment which might be considered in order to meet this requirement. Indicate their relative costs and power consumption.

选择一些可能被考虑的收集设备来满足这个要求。说明它们的实际成本和功耗。

b. What will be the grain-loading in the feed to the collection system?

收集系统的饲料中的谷物装载量是多少?

c. Could a cyclone collector be used in any way? If so, or if not, assuming the inlet duct to be 2.28 ft by 1.09 ft, and the value of $N = 9$ inlet velocity heads, estimate the pressure drop across the cyclone, and the power consumption for the operation.

可以以任何方式使用旋风收集器吗？如果是，或者如果不是，假设入口管道为 2.28 ft×1.09 ft，并且 $N = 9$ 入口速度头的值，估计通过旋风分离器的压降和操作的功率消耗。

# 第 2 次作业

## 旋风除尘器

### 1

(a) A certain cyclone installation is collecting particles of sp.gr. = 2.5 using an inlet velocity of 50 ft/s. What inlet velocity would be required to collect particles of sp.gr. = 1.5 with the same grade-efficiency? How will the pressure drop compare with the original value?

(a) 某旋风分离器装置使用 50 ft/s 的入口速度收集 sp.gr. = 2.5 的颗粒。收集 sp.gr. = 1.5 且具有相同品位效率的颗粒所需的入口速度是多少？压降与原始值相比如何?

若 $\eta_1 = \eta_2$，则由公式 (6.27)-(6.29)：

$$\eta_i = 1 - \exp\left(-M d_{p_i}^N\right)$$

其中：

$$M = 2\left[\frac{KQ}{D^3} \cdot \frac{\rho_p}{18\mu}(n+1)\right]^{N/2}$$

$$N = \frac{1}{n+1}$$

由题意，$K$、$D$、$\mu$、$n$、$N$ 均保持不变，要使 $\eta_1 = \eta_2$，只需要 $Q_1\rho_{p1} = Q_2\rho_{p2}$。

又因为：

$$u_T = \frac{Q}{ab}$$

其中 *ab* 保持不变，则：

$$\frac{u_{T1}}{u_{T2}} = \frac{Q_1}{Q_2} = \frac{\rho_{p2}}{\rho_{p1}} = \frac{2.5}{1.5}$$

计算得到：

$$u_{T2} = 83.3 \text{ ft/s}$$

由公式 (6.45)：

$$\Delta p = 0.0030 \rho_f u_T^2 N_H$$

因此：

$$\frac{\Delta p'}{\Delta p} = \frac{u_T'^2}{u_T^2} = 2.78$$

(b) The cut-diameter for a Swift high-efficiency design cyclone operating under a certain set of conditions is 2.0 μm and the pressure drop is 3.0" $H_2O$. What would be the cut-diameter and the pressure drop for a Stairmand design of the same diameter D, operating at the same flow rate, temperature, grain-loading, etc.?

(b) 在特定条件下运行的快速高效设计旋风分离器的切割直径为 2.0 μm，压降为 3.0" $H_2O$。在相同流速、温度、谷物负载等条件下，相同直径 D 的楼梯设计的切割直径和压降是多少?

由公式 (6.28)-(6.30)：

$$M = 2\left[\frac{KQ}{D^3} \cdot \frac{\rho_p}{18\mu}(n+1)\right]^{N/2}$$

$$N = \frac{1}{n+1}$$

$$d_{p_c} = \left(\frac{0.6931}{M}\right)^{n+1}$$

因此：

$$d_{p_c} = \left(\frac{0.6931}{2}\right)^{n+1}\left(\frac{KQ\rho_p}{18\mu D^2}(n+1)\right)^{-1/2}$$

由 309 页表 2,

对于 Swift high-efficiency design cyclone，$K_{st} = 699.2$，$N_{st} = 7.10$，$b_{st} = 0.21$（D=1），

对于 Stairmond design，$K_{sd} = 551.3$，$N_{sd} = 5.14$，$b_{sd} = 0.2$（D=1）。

$$\frac{d_{p_c\mathrm{sd}}}{d_{p_c\mathrm{st}}} = \sqrt{\frac{K_{\mathrm{st}}}{K_{\mathrm{sd}}}} = \sqrt{\frac{699.2}{551.3}} = 1.126$$

因此：

$$d_{p_c\mathrm{sd}} = 1.126 \times 2.0\ \mu\mathrm{m} = 2.25\ \mu\mathrm{m}$$

由公式 (6.40)：

$$u_T = 16.95 \frac{4g\mu\rho_p}{3\rho_p^2} \frac{(b/D)^{1.2}}{1 - b/D} D^{0.201}$$

因此：

$$\frac{u_{T\mathrm{sd}}}{u_{T\mathrm{st}}} = \frac{b_{\mathrm{sd}}^{1.2}/(1 - b_{\mathrm{sd}})}{b_{\mathrm{st}}^{1.2}/(1 - b_{\mathrm{st}})} = \frac{0.2^{1.2}}{0.8} \times \frac{0.79}{0.21^{1.2}} = 0.93$$

由公式 (6.45)：

$$\Delta p = 0.0030 \rho_f u_T^2 N_H$$

因此：

$$\frac{\Delta p_{\mathrm{sd}}}{\Delta p_{\mathrm{st}}} = \frac{u_{T\mathrm{sd}^2} N_{d\mathrm{sd}}}{u_{T\mathrm{st}^2} N_{T\mathrm{st}}} = 0.93^2 \times \frac{5.14}{7.10} = 0.628$$

$$\Delta p_{\mathrm{sd}} = 3 \times 0.628\ \text{inches}\ \mathrm{H_2O} = 1.88\ \text{inches}\ \mathrm{H_2O}$$

**2**

A cyclone designed to operate at 20 ℃ with a flow rate of 10,800 std. cu.ft./min of air, collecting solid particles of 1.5 gm/cm$^3$ density, has a cut-diamter of 1.96 μm. Estimate the collection grade-efficiency of particles 1.96 μm if this same cyclone were operated at 200 ℃ at a flow rate of 5000 scfm, collecting the same material. The cyclone is of high-efficiency Stairmand configuration and is 5 ft in body diameter.

旋风分离器设计为在 20 ℃下运行，空气流速为 10,800 std. cu.ft./min，收集密度为 1.5 gm/cm$^3$ 的固体颗粒，切割直径为 1.96 μm。如果相同的旋风分离器在 200 ℃下以 5000 scfm 的流速运行，收集相同的材料，则估算 1.96 μm 颗粒的收集级效率。旋风分离器为高效楼梯结构，体直径为 5 ft。

由公式 (6.2)：

$$n = 1 - \left(1 - 0.67 D^{0.14}\right) \left(\frac{T}{283}\right)^{0.3} = 1 - \left(1 - 0.67(5 \times 0.3048)^{0.14}\right) \left(\frac{293}{283}\right)^{0.3} = 0.7077$$

由公式 (6.28)-(6.30)：

$$M = 2\left[\frac{KQ}{D^3}\cdot\frac{\rho_p}{18\mu}(n+1)\right]^{N/2} = 1524.59$$

$$N = \frac{1}{n+1} = 0.5856$$

$$d_{p_c} = \left(\frac{0.6931}{M}\right)^{n+1} = \left(\frac{0.6931}{1524.59}\right)^{0.7077+1} = 1.96\times10^{-6}\ \text{m}$$

同理:

$$n' = 0.6625$$

$$\frac{M'^{n'+1}}{M^{n+1}} = 0.651$$

$$\frac{d'_{p_c}}{d_{p_c}} = \frac{M^{n+1}}{M'^{n'+1}} = 3.06\times10^{-6}\ \text{m}$$

由公式 (6.31):

$$\eta_i = 1 - \exp\left(-0.6931\left(\frac{d_p}{d_{p_c}}\right)^{1/(n+1)}\right) = 41.2\%$$

**4**

Refer to the design example worked out in the text of this Chapter. For the case of the single cyclone, as worked out there, estimate the dimensions and carrying capacity of the spiral dune.

参考本章正文中的设计示例。对于单台风的情况，如前所述，估算螺旋沙丘的尺寸和承载能力。

## 电除尘器

**1**

Using the conditions and values specified for Eqn. (7.9), together with appropriate values for $C_i$ calculate values of the size-dependent term $C_iq_i^*/d_{p_i}$ in Eqn. (7.3) after 1 sec for particle sizes in the neighborhood of 0.2 μm. Show that this term goes through a minimun value. Compare the particle size at which this minimum occurs with that obtained from Eqn. (7.13).

使用方程式（7.9）中规定的条件和值，以及适当的 $C_i$ 值，计算方程式（7.3）中粒径在 0.2 μm 附近 1 秒后的尺寸相关项 $C_iq_i^*/d_{p_i}$ 的值。表明该项经过一个最小值。将出现该最小值时的粒径与从等式（7.13）中获得的粒径进行比较。

**4**

Refer to Example 1 in this chapter:

请参阅本章中的示例 1:

(a) What is the value of the effective migration velocity (or precipitation rate parameter)?

有效迁移速度（或降水率参数）的值是多少?

(b) What is the “cut” diameter?

“切割” 直径是多少?

(c) What value of a “mean” particle size could be used to represent the overall performance? Does this correspond to any of the “means” defined in Chapter 2? How does it compare with Cooperman's $t_{mean}$ given by (7.22) and (7.23)?

“平均” 粒径的什么值可以用来表示总体性能？这是否符合第 2 章中定义的任何 “方法”？它与（7.22）和（7.23）给出的库伯曼 $t_{mean}$ 相比如何?

(d) Estimate the value of the overall collection efficiency if the rate of gas flow were to double during operation.

如果运行期间气体流速加倍，则估计总收集效率的值。

### 7

The fly-ash from a pulverized coal fired furnace has a particle-size-distribution such as given in Feldman's table just below Eqn. (7.19), and a density of 2.5 gm/cm$^3$, It is emitted at the rate of 170 lb/ton of coal fired in a flue gas stream (Mol. Wt. = 28.1) of $14.7 \times 10^6$ cu.ft./hr at 300 °F and 1 atm. A collection system is to be designed to meet the emission regulation of 0.10 lb/million BTU. The coal used has a heating value of 12,800 BTU/lbm and is fired at the rate of 35 tons/hr. Consider the use of an electrostatic precipitator (either with or without a primary collector ahead of it) for this purpose. Estimate the collecting surface required and propose an arrangement for the plates: number in parallel, spacing, height, length and number of compartments.

煤粉炉飞灰的粒度分布如方程式（7.19）下方的费尔德曼表所示，密度为 2.5 gm/cm$^3$，以 170 lb/ton 煤的速率排放，在 300 °F和 1 atm 下以 $14.7 \times 10^6$ cu.ft./hr 的烟气流（摩尔重量 = 28.1）燃烧。收集系统的设计应满足 0.10 lb/million BTU 的排放规定。所用煤的热值为 12800 BTU/lbm，燃烧速度为 35 ton/hr。为此，考虑使用静电除尘器（有或没有初级收集器）。估计所需的收集面，并建议板的布置：平行数量、间距、高度、长度和隔室数量。

## 过滤器

### 1

(a) Repeat the calculations for the conditions of the example of fiber-bed filtration given in the text, except use velocities of 60 fpm, and of 80 fpm. Note the interplay between the face velocity values and L, A, and ΔP for each filter.

对文中给出的纤维床过滤示例的条件重复计算，但使用 60 fpm 和 80 fpm 的速度除外。注意每个过滤器的面速度值与 L、A 和 ΔP 之间的相互作用。

(b) For the conditions of this same example, assume that there is also present an image force brought about by the presence of 90 electronic charges per particle, and that the dielectric constant of the fibers is rather large. Estimate what effect this would have upon the filter dimensions for the case of 40 fpm face velocity.

对于该相同示例的条件，假设还存在由每个粒子 90 个电子电荷的存在而产生的镜像力，并且光纤的介电常数相当大。估计在面速度为 40 fpm 的情况下，这会对过滤器尺寸产生什么影响。

(c) Again with reference to the same example, how would the results of the original case for 100 fpm be affected if the required efficiency were to be 95%?

再次参考同一示例，如果要求的效率为 95%，100 fpm 的原始情况的结果会受到怎样的影响?

**2**

A dust-laden air stream of 10,000 acfm at 70 °F and dust concentration of 2.3 gm/$m^3$ is passed through a fabric filter consisting of 49 bags in parallel, each bag 20 ft long and 1 ft in diameter. Cleaning is by mechanical shaking of all the bags at the same time. Tests indicate that the pressure drop is 3.28" $H_2O$ twenty minutes after shaking, and 3.53" $H_2O$ forty minutes after shaking. Determine:

在 70 °F下，10000 acfm 的含尘气流和 2.3 gm/$m^3$ 的粉尘浓度通过由 49 个平行袋组成的织物过滤器，每个袋长 20 ft，直径 1 ft。通过同时对所有袋子进行机械振动进行清洁。试验表明，振动 20 分钟后的压降为 3.28" $H_2O$，振动 40 分钟后的压降为 3.53" $H_2O$。确定：

(a) air/cloth ratio in use during filtration;

过滤过程中使用的空气/布比率;

(b) the values of $S_E$ and $K_2$;

$S_E$ 和 $K_2$ 的值;

(c) time required to reach a $\Delta P$ = 4.0" $H_2O$;

达到 $\Delta P$ = 4.0" $H_2O$ 所需的时间;

(d) amount of dust collected when $\Delta P$ reaches 4.0";

$\Delta P$ 达到 4.0" 时收集的粉尘量;

(e) the time required to reach $\Delta P$ of 4.0", if an identical arrangement of 49 bags is added in parallel with the present arrangement.

如果与当前布置平行添加 49 个行李的相同布置，则达到 $\Delta P$ 4.0" 所需的时间。

**4**

Refer to Problem 7 of Chapter 7. For the conditions stated there, consider the design of a baghouse filter system to collect the fly-ash. Assume that the fabric will be fiberglass. Make a preliminary design and compare it with that for the electrostatic precipitator design done for that problem.

参见第 7 章的问题 7。对于那里所述的条件，考虑袋式除尘器系统的设计来收集粉煤灰。假设织物是玻璃纤维。进行初步设计，并将其与针对该问题进行的静电除尘器设计进行比较。

## 湿式洗涤器

**2**

A gravity spray tower 3 m high is operating at a liquid-to-gas ratio of 1 l/$m^3$ with a drop diameter of 400 μm. The gas velocity is 0.1 of the drop terminal velocity which is 157 cm/s. The operation is at 20 °C. What is the grade efficiency for particles of 1 μm diameter, having a density of 2.0 gm/$cm^3$?

3 米高的重力喷雾塔以 1 l/$m^3$ 的液气比运行，液滴直径为 400 μm。气体流速为滴头流速的 0.1，即 157 cm/s。操作温度为 20 °C。直径为 1 μm、密度为 2.0 gm/$cm^3$ 的颗粒的分级效率是多少?

**4**

A Venturi scrubber is to be designed to collect dust from an asphalt stone drier. The dust has a mass median diameter of 1.8 μm and a density of 2.6 gm/$cm^3$. The uncontrolled emission rate is 2310 kg/hr, but state regulations require that this be reduced to a maximum of 25 kg/hr. The air flow is 20,000 acfm at 250 °F. No additional data are available. Assuming a throat velocity of 150 ft/s, make a preliminary determination of the necessary L/G value, and of the maximum pressure loss

in the throat. Discuss the additional data and calculations which would be required to make a final design of the Venturi.

文丘里洗涤器用于收集沥青石干燥器中的灰尘。粉尘的质量中值直径为 1.8 μm，密度为 2.6 gm/cm$^3$。非受控排放率为 2310 kg/hr，但州法规要求将其最大值降低至 25 kg/hr。250 °F时的空气流量为 20000 acfm。没有其他可用数据。假设喉部速度为 150 ft/s，初步确定必要的 L/G 值和喉部的最大压力损失。讨论文丘里管最终设计所需的额外数据和计算。